BCS THE CHARTERED INSTITUTE FOR IT

BCS HIGHER EDUCATION QUALIFICATIONS
BCS Level 4 Certificate in IT

SOFTWARE DEVELOPMENT

Wednesday 6th October 2021 - Afternoon

Time: TWO hours

Section A and Section B each carry 50% of the marks.
You are advised to spend about 1 hour on Section A (30 minutes per question)
and 1 hour on Section B (12 minutes per question)

Answer the Section A questions you attempt in Answer Book A
Answer the Section B questions you attempt in Answer Book B

The marks given in brackets are **indicative** of the weight given to each part of the question.

Calculators are **NOT** allowed in this examination.

SECTION A
Answer 2 questions (out of 4) in Answer Book A. Each question carries 30 marks.

A1.

a) Define the term *algorithm* and briefly explain what is meant by *inputs*, *outputs*, *repetition* and *selection* in relation to algorithms.

(10 marks)

b) State **TWO** reasons why we might use pseudocode to write an algorithm.

(4 marks)

c) Write an algorithm in pseudocode to calculate and display the sum of a set of positive numbers entered by a user. The user enters a series of numbers that will be added to the sum and enters a negative number to indicate that all the numbers have been entered**.**

(6 marks)

d) How might the above algorithm be presented as a flowchart? What are the advantages and disadvantages of presenting algorithms in this way?

(10 marks)

A2.

a) The following pseudocode algorithm calculates the area of a floor in order to calculate the required size of a carpet. Trace the values in each variable after the execution of each line. You should assume an input value of 30.5 for length and 25 for width.

1. Display “What is the width of the floor?”
2. Input width
3. Display “What is the length of the floor?”
4. Input length
5. area = length * width
6. Output “For your floor you will need a carpet that is:”
7. Output area

(10 marks)

b) State what data types should be used for the following variables and explain your answer.

i) The name of a carpet manufacturer;
ii) The phone number of a customer;
iii) The date an order was placed;
iv) The length, width and area of a floor in metres;
v) The number of different carpets a customer has ordered.

(10 marks)

c) With reference to the algorithm above in part a), write the function CalculateFloorArea in a language of your choice. In the same language, write code which inputs values for length and width, calls CalculateFloorArea and then outputs the value returned from the function.

(10 marks)

A3.

a) Explain the term *functional programming*.

(10 marks)

b) What is *modular programming*? When following this approach how should we develop test plans?

(10 marks)

c) Is *modular programming* compatible with an *object-oriented* approach to software development? Give reasons for your answer.

(10 marks)

A4.

a) Write code in a language of your choice to find the highest exam mark in a list of numbers each of which represents the percentage mark obtained by a student in a single exam. Your code should not rely on any built-in functions available in your chosen language.

(10 marks)

b) Explain how features of your chosen programming language could help you to store the exam marks in a file.

(10 marks)

c) What would be the advantages and disadvantages of storing information about students in an indexed sequential file?

(10 marks)

[Turn Over]

Section B
Answer 5 questions (out of 8) in Answer Book B. Each question carries 12 marks.

B5.

A natural number is defined as any non-negative integer (0,1, 2, 3, 4, etc.). To compute the sum of all natural numbers for a given positive integer N, requires successive additions of all natural numbers in the range 1 to N.

For example, for an input value N = 3 a value of 6 would be computed because (1+2+3=6).

a) Explain the difference between *iteration* and *recursion***.**

(4 marks)

b) Using recursion write a function called FnRecurse, that will return the sum of all the natural numbers of a given integer passed as a parameter.

(5 marks)

c) Write a program that calls the function FnRecurse. The program prompts the user to type in a positive integer and displays the result.

Example output:

```
>>> "Enter a positive integer:"
3          (the user types in a number)
>>> "The sum of all the natural numbers = 6"   (output)
```

(3 marks)

B6.

a) Explain the difference between a *linear search* and a *binary search*. Discuss under what conditions a *binary search* is more efficient than a *linear search*.

(5 marks)

b) Show using any algorithm of your choosing, the steps required to sort the following array of integers into ascending order 14, 33, 27, 10, 39, 19, 42, 44

(7 marks)

B7.

a) Outline the main differences between the *object-oriented* programming and the *procedural programming* approaches to software development.

(4 marks)

b) Describe **EACH** of the following *object-oriented* programming constructs present in the following code sample:

i) Class;

(2 marks)

ii) Subclass;

(2 marks)

iii) Properties;

(2 marks)

iv) Methods.

(2 marks)

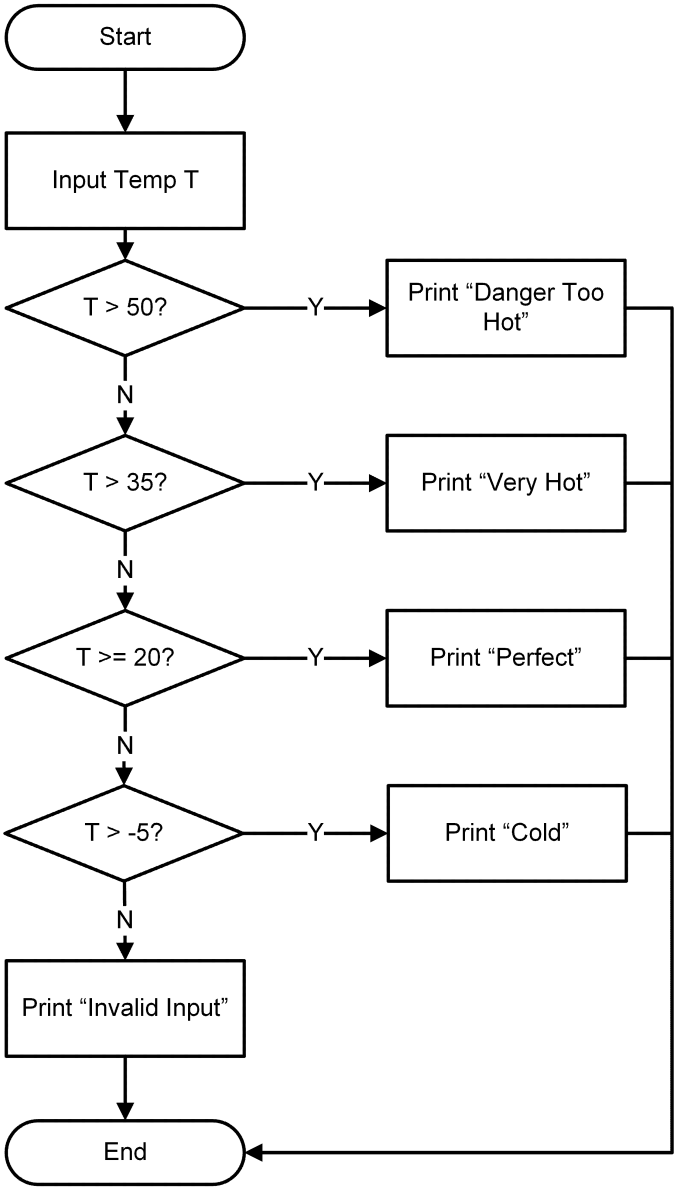
```
class Clock
{
private:
    int hours;
    int minutes;
    int seconds;
public:
    void setClock(int, int, int);
};

class AlarmClock : public Clock
{
private:
    int alarmHours;
    int alarmMinutes;
    int alarmSeconds;
public:
    void setAlarmClock(int, int, int);
};
```

[Turn Over]

B8.

Refer to the following flow chart;



a) Convert the flow chart into program code.

(4 marks)

b) Produce a table, containing a range of test data and expected output, to check the logic of the code you wrote in part a).

(4 marks)

c) Suppose in the outcome of your tests in part b), the actual result is not the same as the expected result.

Explain how you would debug the code to find the errors in your code.

(4 marks)

B9.

A company is looking to automate a range of business functions. The company needs to decide whether to build its IT infrastructure using bespoke or off-the-shelf packaged software.

a) Describe *bespoke software* and *off the shelf packaged software* highlighting the major differences between them.

(6 marks)

b) Describe the advantages and disadvantages in purchasing bespoke software rather than off the shelf packaged software.

(6 marks)

B10.

For **THREE** of the following topics, describe each of the two terms relating to that topic and highlight the differences between them:

Topic	**Terms**
Procedure Calls	Parameters vs Arguments
Data Processing	Flat File vs Two-Dimensional Array
Program execution	Interpreted vs Compiled code
Testing	White Box vs Black Box

(12 marks)

B11.

Refer to the following code

```
IF a > b THEN IF a > c PRINT a ELSE PRINT c ENDIF ELSE
IF b > c THEN PRINT b ELSE PRINT c ENDIF ENDIF ENDIF
```

a) Rewrite the above code to make it more readable.

(4 marks)

b) State the overall function of the code. Justify your answer by tracing through the code with a set of input data.

(4 marks)

c) Explain what is meant by a logical error. Change the code above to illustrate the cause and effect of a logical error.

(4 marks)

[Turn Over]

B12.

a) List and briefly comment on **FOUR** important principles that can be used to guide the design of user interfaces.

(8 marks)

b) Explain how **TWO** of the principles you stated above would influence the design of a user interface for a web site for a company that needs to promote or advertise its business and services.

(4 marks)

End of Examination